6

WATER

This chapter provides ordinance, policy, and standards establishing minimum design criteria for constructing and modifying water systems to be owned and operated by the city. It provides guidance on agreements, design report preparation, transmission and distribution systems, fire protection, and final plans preparation.

Water Resources
9388 E San Salvador Drive
480-312-5685

Water Operations
9312 N 94th Street
480-312-5650

Water Quality
8787 E Hualapai Drive
480-312-8732

One Stop Shop
7447 E Indian School Road
Suite 100
480-312-2500

Current Planning
7447 E Indian School Road
Suite 105
480-312-7000

Plan Review
7447 E Indian School Road
Suite 125
480-312-7080

Fire Department Plan Review
7447 E Indian School Road
Suite 125
480-312-7080

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WATER

6

GENERAL INFORMATION 6.000

A. Ordinance Requirements

Developers shall install, at their expense, all improvements necessary to provide water service to their development. This will include any pump stations, reservoirs, transmission mains, pressure reducing valves, or other facilities, and the payment of all required development fees (Section 49-73).

There is a program for extension of the city's water system to newly developed areas and subdivisions inside the city's service area where city water service is desired and available (Section 49-212).

The City Code can be found on-line at www.scottsdaleaz.gov/codes.

B. Design Policy

A civil engineer registered in the state of Arizona shall analyze all proposed development that is determined by the city to have an impact on the water distribution system. The effects of peak and fire flow demands will be examined to ensure proper sizing and layout of proposed water system facilities.

ENVIRONMENTAL QUALITY REQUIREMENTS 6.001

Maricopa County Environmental Services Department (MCESD) is required to review and approve all public water main extensions and construction of water related facilities within the city's service area, prior to the city approving the final plans. Relocation or realignment of an existing water line to resolve a utility conflict does not require County approval.

Engineering Bulletin No. 10, "Guidelines for the Construction of Water Systems" published by the Arizona Department of Environmental Quality, and **Arizona Administrative Code**, "Title18 - Environmental Quality," contain specific requirements for submittals, approvals, and notifications when extension of a public water line is proposed. Some of the provisions of these documents are outlined below. It is the responsibility of the developer and the engineer to read and comply with the applicable requirements of these documents.

1. Prior to city approval of final plans, the developer will submit a cover sheet for the final plans with a completed signature and date of approval from MCESD.
2. Before commencing construction, the contractor or developer will provide documentation to the city public works inspector that a Certificate of Approval to Construct and/or Provisional Verification of General Permit Conformance has been approved by MCESD.
3. Before building permits are issued, the developer will submit to the city public works inspector a Certificate of Approval of Construction and/or Verification of General Permit Conformance signed by MCESD for the water line extension.
4. Prior to Inspection Services issuing a Letter of Acceptance, the developer must deliver to the Public Works Inspector an acceptable set of full-size 4 mil as-built Mylars of the improvements.

6.002 PRIVATE WATER COMPANIES

Portions of Scottsdale's municipal area are provided water service by private water companies. Figure 6-1 below delineates those areas.

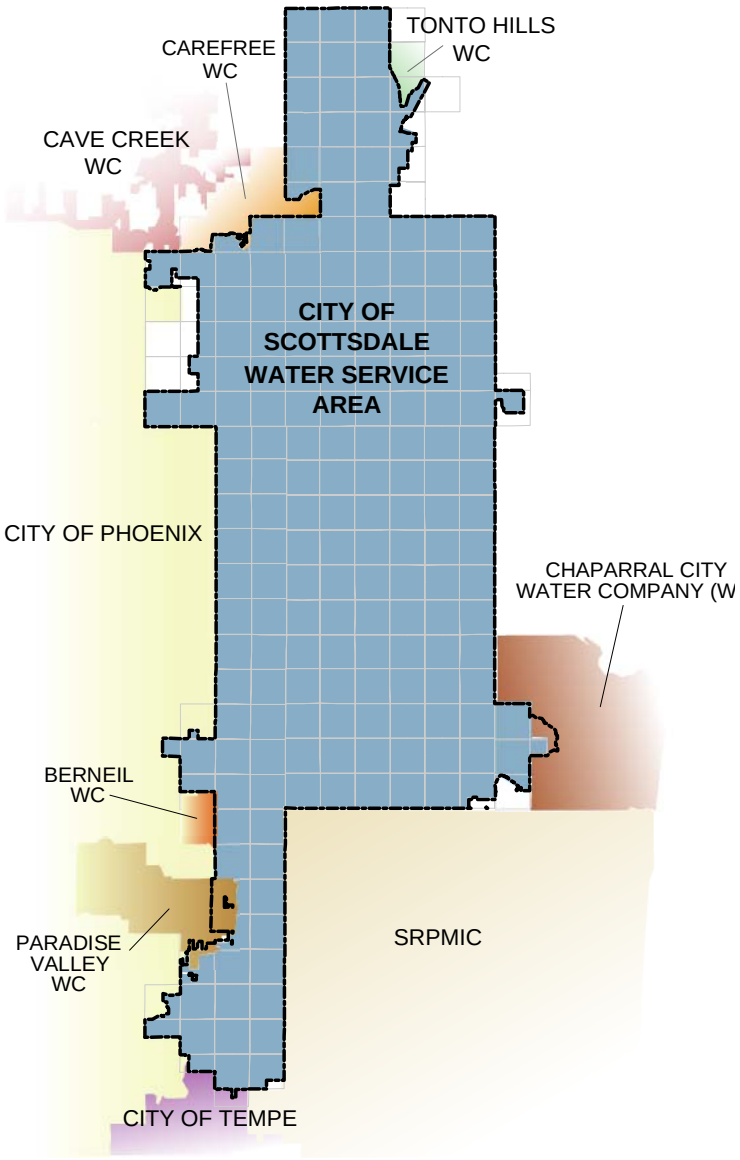


FIGURE 6-1. WATER SERVICE AREAS – MARCH 2004

Proposed private water lines located within the city's rights-of-ways or easements will require an agreement between the city and the private water company delineating liability and maintenance responsibilities. Water line design and materials shall comply with the requirements for city water lines.

Private water companies should review and approve construction of, and modification to, water systems within their franchise areas. The developer will submit to Plan Review Services written documentation that the private water company has approved their facilities shown on the final plans before the city grants approval.

The city cannot provide water service within private water company franchise areas, and will not review private water system plans unless requested by the water system owner or

the work will occur within the city's rights-of-way or easement. In cases where the city is requested to review private water systems, the applicable review fees must be paid. A note will be placed on the final plans stating that the operation and maintenance of franchise lines is not the responsibility of the city.

AGREEMENTS 6.100

Developers and property owners who install improvements to the public water system may be eligible to request a credit, oversizing, or payback agreement with the city allowing for partial reimbursement of costs to design and construct those improvements.

A. Ordinance Requirements

Developers who construct water system improvements may receive credit for such construction (Section 49-74.2). The city has specific reimbursement agreements for developers or property owners that allow them to collect line payback charges and compensate them for the cost of oversizing water lines (Section 49-212).

CREDIT AGREEMENTS 6.101

Credit agreements are established to compensate a developer for installing system infrastructure that has been identified in the city's Capital Improvement Plan and/or included in the most recent Development Fees Report. Credit agreements are set up through the Water Resources Department and are to be identified in the developer's master plan.

OVERSIZE AGREEMENTS 6.102

Oversizing Agreements will allow the city to compensate developers for the cost to install a water line larger than what is minimally required to serve the development. This typically occurs where water extensions are proposed on mile and half-mile (section and mid-section line) streets, or areas with projected future growth. All oversizing projects involving city funds must have an oversizing agreement and must meet all city requirements prior to plan approval and construction. The city can only participate in the cost of oversizing provided there are sufficient funds in the capital improvements budget, and the amount does not exceed the limitations set forth by the **Arizona Revised Statutes**, Title 34, Article 2, Paragraph 201.D. If sufficient funds do not exist, the oversized lines will be installed at the developer's cost. For more information on oversizing agreements contact the Water Resources Department.

PAYBACK AGREEMENTS 6.103

Developers may request a line extension payback agreement when they construct local distribution lines across frontages of parcels not currently receiving water service from the city. When a designated parcel requests water service, a prorated cost of the water line is collected by the city and returned to the developer. Line extension payback agreements are set up through the Water Resources Department. For questions or details on procedures to initiate an agreement, contact the Water Resources Department.

WATER SERVICE AGREEMENT 6.104

The County's Water Service Agreement form should be completed by the engineer and submitted with the final plans to the One Stop Shop. Plan Review staff sign the water and wastewater service agreement and Solid Waste Management Division sign the refuse service. It is the owner's responsibility to obtain these signatures from the respective city divisions. The agreements will not be signed prior to the city approving the final plans. Following is specific information regarding the Scottsdale municipal water system and the appropriate identification numbers:

- **Potable water system # 07- 098**
- System Name: City of Scottsdale Water Campus
- Address: 8787 E. Hualapai Dr, Scottsdale, AZ 85255

6.200 DESIGN REPORTS

Water master plans and basis of design reports shall provide an analysis of the impact that a development will have on the city's water system. These reports are reviewed and accepted by the Water Resources Department, then utilized by Plan Review Services to verify the infrastructure to be constructed. Accepted design reports are retained in the city's Records Division and are made available to developers and engineers upon request.

A. Design Policy

A civil engineer registered in the State of Arizona must analyze all proposed development that is determined by the Water Resources Department to have an impact on the water system. The effects of average day flow, peak hour flow, and max day plus fire flow will be examined to ensure proper sizing and layout of the proposed water system.

A water master plan or a water basis of design report is required for each development within the city when an extension of the public water line is necessary. Water Resources staff will determine which report is appropriate for a given development and convey this requirement to the city's project coordinator for inclusion in the case's stipulations. Reports shall be separately submitted for review to the One Stop Shop, directed to the attention of the Water Resources Department. The reports will be reviewed and accepted by the Water Resources Department prior to the submittal of final plans for review by Plan Review Services, unless otherwise agreed to by Plan Review Services.

6.201 WATER MASTER PLAN

A Water Master Plan is required when a change in the existing zoning or land use is proposed, phased construction is proposed, or conditions are present where the Water Resources Department determines one is necessary.

The objectives of a master plan are to demonstrate that the proposed water system complies with both the most recent update of the city's **Integrated Water Master Plan** and the city's design criteria and development policies for each phase of the project. It should also establish a skeletal system for the phased development of a master planned project.

6.202 WATER BASIS OF DESIGN REPORT

Most projects within the city will require a basis of design report. The objectives of a basis of design report are to verify the water demand, available system flows and pressures, and proposed hydraulics of a development, or to demonstrate conformance for each phase of a master planned development with the accepted master plan for that development.

6.203 GENERAL REPORT REQUIREMENTS

All reports submitted to the city for review shall be prepared in accordance with the guidelines listed below.

A. General Format

1. The report should be on letter-sized paper (8 1/2 x 11).
2. There should be one-inch margins on all sides.
3. The report should be bound along the left edge.
4. All reports will have a table of contents.

5. Maps and other supporting materials larger than folded ledger size paper (11 x 17) should be placed into sleeves as an appendix to the report.
6. A civil engineer licensed to practice in the State of Arizona must seal each report.

B. Report Covers

1. Covers should consist of hard stock paper or better.
2. The project name shall be located on the cover.
3. The name, address, and phone number of the developer/owner and engineer shall be stated on the cover.
4. The original submittal and any subsequent revision dates shall be located on the cover.

C. Vicinity Map

1. Identify the project's location with respect to major cross streets.
2. Identify all major existing and proposed developments within a one-mile radius.

WATER BASIS OF DESIGN REPORT CONTENT 6.204

A. Introduction

Summarize the proposed development.

1. Include a legal description based on sectional breakdown or reference within a platted development.
2. Describe the existing and proposed site zoning and land uses.
3. Include reference to elements of the city's General Plan and identify any designated character area or studies that will affect the project's design.

B. Design Documentation

Reference design compliance with the latest revision of this manual and all other applicable design standards and codes.

1. Include a discussion of which design procedures, policies, and methodologies will be incorporated into the design engineering of the water system.
2. List the title and version of any software used in the design analysis.

C. Existing Conditions

1. State the existing zoning and land use.
2. Describe the existing, topography, vegetation, and landform features.
3. Include the location and description of existing utilities in the vicinity.
4. Reference any existing master plans or design reports applicable to adjacent development.
5. Indicate the results of certified flow testing of the existing water system.

D. Proposed Conditions

1. Include a site plan that indicates the layout of the proposed development.
2. Describe the proposed connection(s) to the city's water system. Show looping and/or extension of water lines into the site. Indicate locations of all zoned boundary lines.
3. Provide a second sourcing for all water supply systems when necessary to meet the requirements of the Fire Department.
4. Reference which water zone the site is within and address all required fire flows and system pressures.
5. Address maintenance responsibilities of the proposed water.

E. Computations

1. Base generated water demands upon the unit demands listed in Figure 6-2.
2. Verify any variance from the stated design flows with the Water Resources Department.

AVERAGE DAY WATER DEMANDS				
Land Use	**Inside Use**	**Outside Use**	**Total Use**	
Residential Demand per dwelling unit:				
< 2 DU/ac	208.9	276.7	485.6	per unit
2 – 2.9 DU/ac	193.7	276.7	470.4	per unit
3 – 7.9 DU/ac	175.9	72.3	248.2	per unit
8 – 11.9 DU/ac	155.3	72.3	227.6	per unit
12 – 22 DU/ac	155.3	72.3	227.6	per unit
High Density Condominium	155.3	30	185.3	per unit
Resort Hotel	401.7	44.6	446.3	per unit
Service and Employment:				
Commercial/Retail	0.7	0.1	0.8	per sq.ft.
Commercial High Rise	0.5	0.1	0.6	per sq.ft.
Office	0.5	0.1	0.6	per sq.ft.
Institutional	670	670	1340	per acre
Industrial	873	154	1027	per acre
Research and Development	1092	192	1284	per acre
Special Use Areas:				
Natural Area Open Space	0	0	0	per acre
Developed Open Space – Parks	0	1786	1786	per acre
Developed Open Space – Golf Course	0	4285	4285	per acre

FIGURE 6-2. AVERAGE DAY WATER DEMANDS IN GALLONS PER DAY

3. Use H2ONET, WATERCAD, or EPANET software for any computer modeling of water flows and pressures. Other software products may be authorized by the Water Resources Department.
4. Analyze the water system for average day, maximum day, peak hour, and maximum day with fire demand.
5. Show in calculations that the minimum water pressure requirements are met at the highest proposed finish floor elevation (with and without fire flow).
6. Indicate in water pipeline calculations the head losses per 1000 feet, pipe capacity, pipe velocity, and pipe size.
7. Include diagrams clearly showing all water pipe and node references.
8. Pay particular attention to water demand factors used for restaurants or specialty developments.
9. Use scour analysis where surface flows exceed 500 cfs.

F. Design Documentation

1. Submit electronic copies of all computer calculations for the water analysis along with the final report.
2. Ensure all common spreadsheet formats are compatible with MS Excel.

G. Summary

1. Provide a summary of the proposed water improvements stating that all the city's design standards and policies have been met or indicate any variance or exception. Note why the developer is requesting any variance or exception.
2. Include a brief project schedule indicating the proposed start and completion of the developments improvements.

H. Supporting Maps

Include a scaled site plan showing all existing and proposed utility lines and surface improvements.

1. Graphics should screen the development's background, dash existing utilities, and present proposed utilities as bold solid lines.
2. Screen existing topography into the background. At two-foot intervals, clearly label all existing and proposed contour intervals. Show sufficient information to evaluate pipe cover.
3. Show, dimension, and label clearly all property lines, rights-of-way, tract, and easement lines.
4. Show any water zone boundary lines corresponding to the topography, as it exists, and any major ridgelines within the development.

I. Miscellaneous

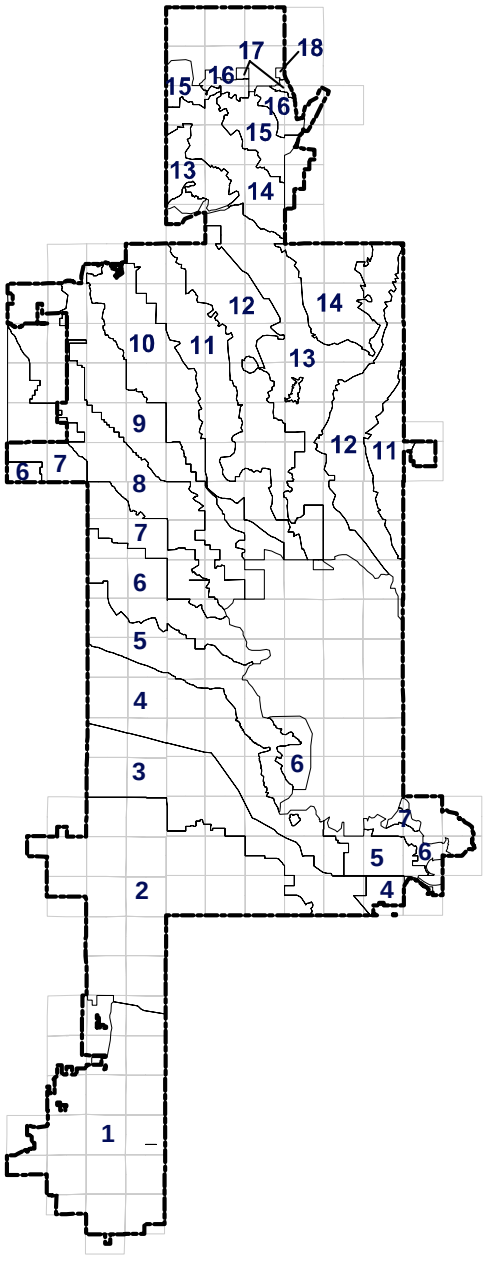
Requests for more specific information regarding report requirements and the water distribution system may be obtained by contacting the Water Resources Department.

WATER MASTER PLAN REPORT CONTENT 6.205

When required by the city, a water master plan report will be prepared in accordance with this manual by a professional engineer registered in and licensed to practice in the State of Arizona. The master plan report shall address, but not be limited to the following:

1. The water master plan report will specify the terms and requirements for water service to the development.
2. All development projects will be responsible for determining their specific water system needs and include the projections for future surrounding developments to ensure there is no strain on the system.
3. A computer water network model, using H2ONET, WATERCAD, or EPANET, will be used for the analysis of pressure and flow within the distribution system verifying that adequate pressures and flows will be available within the development. In addition, if certified flow tests performed on the system to which the project is to be connected do not show that sufficient capacity exists, the computer model will be used to determine the required on-site and off-site facilities, such as pump stations and pipelines, necessary to serve the project. If the proposed development requires a change in zoning which increases density or proposes a water system different from the city's Integrated Water Master Plan, then additional off-site calculations will be required. All model data shall include the following:
    a. Demands will be calculated according to densities shown in Figure 6-2, Average Day Water Demands in Gallons Per Day.
    b. The system will be capable of providing maximum day demands plus fire flow.
    c. Verification of the ability to provide peak hour demands will be provided.
    d. Verification that the minimum required pressure throughout the water distribution system is achieved at the highest finished floor elevation and the minimum residual pressure is maintained under fire flow conditions
    e. Pipe line calculations will show the head loss per 1,000 feet of all pipes during peak period demand periods and maximum day conditions.
    f. Sufficient supply for demand must be provided without the use of dedicated fire pumps or back-up pumps. Calculations that include both domestic demand plus fire flow may use fire pumps as a portion of the supply.
    g. A computer disk containing all calculations will be submitted along with the master plan report.

4. Each Master Plan map must show the following:
   a. All proposed on-site and off-site facilities including, but not limited to, pump stations, transmission and distribution mains, and reservoirs.
   b. Proposed street locations, parcel boundaries and proposed lots within each parcel.
   c. Labeled contour lines at two-foot intervals or sufficient information to evaluate network node elevations.
   d. Pressure zone boundaries, (see Figure 6-3), pressure reducing valves (PRVs) and corresponding zone valves.
   e. Size and pressure settings for all PRVs.



Zone	Ground Elevation Range (Ft.)
1	1180-1280
1A	1250-1330
2A	1280-1330
2	1330-1440
3	1440-1550
4	1510-1650
4E	1550-1650
5	1650-1790
5E	1650-1750
6	1790-1920
6E	1750-1934
7	1920-2050
7E	1934-2065
8	2050-2180
8E	2065-2200
9	2180-2310
10	2310-2440
11,11E	2440-2570
12,12E	2570-2700
13	2700-2830
14	2830-2960
15	2960-3090

FIGURE 6-3. PRESSURE ZONE MAP

5. Include a vicinity map showing existing and proposed streets to a distance of one mile from the exterior boundaries of the project.
6. Include a construction schedule in a table format for all water related construction required to serve the development. The schedule will address each phase or parcel and how it relates to an orderly extension of the water system.
7. Demonstrate compliance with the adopted city's Integrated Water Master Plan encompassing the respective area.

Master planned developments that design a distribution system that will be phased will provide a synopsis of the phasing to the Water Resources Department upon acceptance of the Water Master Plan.

For specific information regarding water plan requirements and/or the city's current Integrated Water Master Plan, contact the Water Resources Department.

WATER FACILITIES 6.300

Water facilities (wells, reservoirs, and booster pump stations) are typically designed and constructed by the city through its capital improvement program. Developers needing to construct water facilities should contact the Water Resources Department and request a meeting. The developer should be prepared to address how the proposed system will conform to the Integrated Water Master Plan. The city will address design issues, the review process for facilities, and any potential city cost participation.

A. Design Policy

Unless otherwise agreed to in writing by the city's Rights-of-Way Agent, water facilities will be located on a tract or lot dedicated to the city (conveyed by a general warranty deed) and accompanied by a title policy in favor of the city.

WELLS 6.301

The Water Resources Department will be notified of any proposed well drilling. Under the Arizona Groundwater Management Code, the Arizona Department of Water Resources (ADWR) regulates all groundwater wells in Arizona. Before drilling and installing a well, a Notice of Intent to Drill and an Application for a Drilling Permit must be obtained from, and filed with, ADWR. The well must subsequently be registered with ADWR. Forms and additional information are available from ADWR's Operations Division, 602-417-2400, and online at www.water.az.gov/.

RESERVOIRS 6.302

Storage facilities must provide emergency fire protection and be designed to maximize the efficient use of water production wells and pumping facilities. Therefore, storage in each pressure zone will exceed each of the following criteria:

- Three hours fire flow reserve plus twenty five percent of the maximum day demand.
- One average day demand.

BOOSTER PUMP STATIONS 6.303

Booster pumps will be designed as required to maintain adequate pressure for domestic and fire protection water supply. The city's current pump system design criteria, details, and specifications are available through the Water Operations Division. All stations shall provide at a minimum, chlorination equipment, variable frequency drive pumps, backup power supply, and telemetry compatible with the Water Resources Department current

system. Designers shall refer to Engineering Bulletin No. 10 by the Arizona Department of Environmental Quality for additional design criteria.

A preliminary design criteria report must be prepared and submitted to the One Stop Shop for review and acceptance by the Water Resources Department prior to submittal of final plans for review. This report shall outline the type of equipment and controls proposed for the station along with the proposed hydraulics. A final design criteria report prepared by a registered civil engineer licensed in the State of Arizona must accompany the construction drawings.

6.400 TRANSMISSION & DISTRIBUTION SYSTEMS

A. Ordinance Requirements

Individual properties that are not within 660 feet of the public water distribution system have the option to extend the public water system, drill a separate well for each individual property, or haul water (Section 49-75).

Water mains shall be extended to provide water service upon development of a property if an approved source is within 660 feet of the nearest property line of the development (Section 49-75).

The city requires water mains to be installed along the entire length of the property line frontage of that property being developed. The property line frontage is defined as that portion of a parcel of property that abuts a street, easement, or public rights-of-way. If a parcel to be developed has more than one frontage, improvements shall be installed along all frontages (Section 49-212).

B. Design Policy

The city may require the extension of water lines along a frontage, or through a subdivided or split parcel, to the boundary where future extension of the water line is possible, providing a point of service to adjacent properties, or as determined necessary by the city.

Each lot will have safe, reliable, and potable water in sufficient volume and pressure for domestic use and fire protection. This shall be verified by the engineer, in part, by performing a flow and pressure test of that part of the potable system to be extended or connected to. The flows and pressure must meet minimum requirements for domestic and fire flow per Section 6.501. The engineer shall place a statement verifying this on the cover sheet of the final plans.

The city's water distribution system operates on a grid system. Minimum line size requirements for this grid are as follows, unless otherwise approved by the Water Resources Department:

1. Mile and half-mile alignments must be minimum 12 inch.
2. Quarter mile alignments must be minimum 8 inch.
3. Water lines located in the city's county service area must be a minimum 8 inches unless otherwise approved by the Water Resources Department.
4. All other alignments must be minimum 6 inch.

The grid system and frontage requirements may be reevaluated through a master planning process where density, topography, and other environmental features are considered. Upon acceptance of a master plan for the reevaluated area by the Water Resources Department, detailed design reports for each developing parcel within the master planned area are required. Acceptance of the detailed design report, complying with the accepted master plan, provide a variance from the normal grid and water line frontage requirements.

The city maintains several pressure zones and care must be taken to identify boundary conditions when designing near a zone line. See Figure 6-3 for water pressure zone

boundaries. Static water pressure tests will be taken on a fire hydrant located on each leg of the existing water system where connections are proposed. See Section 6.405.

C. Design Standards

The engineer should be familiar with the MAG Uniform Standard Specifications for Public Works Construction and the COS Supplement to MAG Uniform Standard Specifications for Public Works Construction, including all applicable Standard Details. These documents contain construction related specifications and details that impact the design of water systems including trenching, bedding, backfill, pavement replacement, etc.

MATERIALS 6.401

1. Water distribution lines are 6 inch through 12 inch in diameter and shall be ductile iron (DIP) with a minimum pressure class of 350.
2. The city does not allow 10 inch, 14 inch, or 18 inch water lines for new construction.
3. Water transmission lines 16 inch and larger, may be DIP, mortar lined steel, steel cylinder pretensioned pipe, or an approved equal by the Water Resources Department. The pressure class will be verified with the Water Resources Department.
4. The use of AWWA C-900 PVC is prohibited in the Scottsdale water system.
5. Fire line services 3 inches and larger located within rights-of-way and public easements shall be constructed of ductile iron pipe, class 350. AWWA C-900, class 200 pipe is acceptable for on-site fire line services outside the rights-of-way and public easements.
6. Design calculations for wall thickness will be required in cases where pipelines could be subjected to heavy external loads. These include, but are not limited to, pipelines crossing under storm drain lines greater than 36 inches diameter, pipelines in the roadway alignment that would be exposed to heavy construction vehicle loads prior to paving, and installations exceeding the pipe manufacturer's maximum depth of bury.
7. All ductile iron water lines are to be specified with polyethylene wrapping. Designs specifying the installation of other acceptable metallic pipe materials will require soil testing in accordance with procedures of the American Ductile Iron Pipe Research Association. Such tests shall be submitted to the city with the final plans submittal to determine if cathodic protection is required in the design.
8. Polyethylene locating tape (color coded blue) will be placed above all public water lines.

SYSTEM LAYOUT 6.402

To provide appropriate water pressure, water circulation, and redundancy, all new water mains must be designed in a looped configuration, providing a minimum of two sources that can be isolated by a gate valve, except as provided for in Section 6.403, for maximum dead-end line length and size requirements.

In general, water distribution lines will be on the north and east side of the street, 2 feet behind the curb, sidewalk, roadway, or as otherwise approved by the Water Resources Department. Water transmission lines will be located under the roadway section unless otherwise approved by the Water Resources Department.

All water lines will be aligned parallel to property lines or street center lines and shall not cross and re-cross the center line, except in cases justifiable to the city.

Curved water lines are permissible where the individual joint deflection does not exceed 4 degrees in design and 5 degrees in construction.

Developments with numerous curved streets will be discussed with the Water Resources Department to decide whether the city will consider a design report with water and sewer layouts in accordance with the following criteria:

1. Water and sewer mains will be placed under the paved section of the roadway within the area from back of curb to back of curb.

2. All water mains must maintain 3 feet horizontal clearance to dry utilities.
3. The water main and sewer main will run parallel to each other with 9 feet of separation to the pipes' centerline in order to maintain 6 feet of clearance at manholes. Lines may cross the street centerline.
4. Deflections in the water line shall be designed to nominal fitting angles within standard tolerances and will occur at the same locations where the sewer line is deflected.

Reference Section 7.402 for related sewer criteria. The above criteria will be consistently and uniformly applied throughout each phase, parcel, or unit of a development.

Water lines in commercial, multifamily, and industrial developments should be located under driveway areas, and provided with an easement or tract where permanent 20-foot minimum access for maintenance purposes is maintained. In developments where other dry utilities, or private sewers are to occupy the same driveway, Plan Review Services may accept a 16-foot wide public water line easement. The dry utilities and private sewer will not be allowed to run parallel within the easement.

Hydrants, meters, blow-offs, and valves shall not be located in washes, detention areas, retention areas, driveways, or sidewalks. Hydrants must have depth of burial of 3.5 feet.

Hydrants that require adjustment as a result of improvements will be adjusted using a "Gradelok" or approved equal when vertical adjustment is in excess of 6 inches. Reference COS MAG Supplement Section 610.8.

Existing water line stubs adjacent to a proposed development that are not used will be abandoned and plugged at the main.

6.403 DEAD-END LINES

Terminal water lines in the city will comply with the following requirements:

1. The maximum length for a dead-end water distribution line, 8 inch diameter to 12 inch diameter, will be 1,200 feet in length.
2. Dead-end lines 1,000 feet or less may be 6 inches minimum in diameter provided adequate pressure and fire flow rates are maintained.
3. Dead-end lines for water transmission lines 16 inches and larger, exceeding 1,200 feet in length must be approved by the Water Resources Department.

Capped dead end lines will be fitted with a flushing device as per MAG Standard Detail No. 390, Type "B." Valves on dead end lines that may be extended should be provided with two full pipe lengths between the valve and the plug for lines 12 inches and larger and one full pipe length for lines smaller than 12 inches. Blow-off valves, fire hydrants, or other suitable means will be installed at the end of dead-end mains to allow periodic flushing of the lines. Flushing devices shall not be located in washes, detention areas, retention areas, sidewalks, driveways, or paved areas.

6.404 DESIGN FLOWS

The ultimate design flow within the city's water transmission and distribution system will be based on the city's current Integrated Water Master Plan. Water demand for each development will be calculated using the average day demands as shown in Figure 6-2, to ensure that the existing distribution supply is sufficient. Designs will include all necessary improvements, including booster pumping stations, reservoirs, lines, and appurtenances, to meet the system's ultimate demand.

Hydraulic calculations will demonstrate that the system will provide both peak hour demand and maximum day demand including fire flow. The peaking factors are 2 times the average day for maximum day, and 3 1/2 times the average day for peak hour. These factors may be increased for restaurants and high demand water users.

The maximum allowable pipe headloss for transmission lines is eight feet per one thousand feet (8'/1000'); for distribution lines it is 10 feet per 1000 feet (10 ft / 1000 ft).

Design flows for all distribution systems will be based upon flow and pressure of the existing system as documented by the engineer. See Section 6.405.

Prior to acceptance by the city, all platted subdivisions will conduct an additional flow test at the lowest and highest elevation available in which the development is constructed. Developments that cross pressure zone boundaries must conduct a flow test within each pressure zone as outlined above. The results of this test, along with a copy of the final plans, shall be submitted to Inspection Services for review and acceptance.

FIRE HYDRANT FLOW TEST REQUIREMENTS 6.405

Pressure and available flow information for existing water lines must be obtained by having a flow test performed on the system. Flow tests are required for all commercial projects, multifamily residential projects, and public extensions of the city's water distribution system. A private fire protection company will perform the tests and certify the results. See www.scottsdaleaz.gov/design/dspm/forms/ for the flow test design form. The certified form must be included in all master plans or design reports submitted to the One Stop Shop, or submitted along with the final plans to Plan Review Services should a design report not be necessary. Flow tests will be conducted during periods of high water use, i.e. 6:00 am to 8:00 am.

An encroachment permit issued by the One Stop Shop is required for a flow test and the Inspection Services Division will be notified a minimum of 48 hours before performing the flow test. The permit is also available on-line through the city's website at www.scottsdaleaz.gov/onestopshop.

PRESSURE REQUIREMENTS 6.406

Pressure extremes in water systems result in potential for contamination to enter the network. Low pressures in the water system may allow polluted fluids to be forced into the system, and high pressures may cause ruptures or breaks in the network.

The static pressure in the distribution system should not exceed 120 pounds per square inch (psi), and the system shall be designed to maintain a minimum residual pressure of 50 psi at the highest, finished, floor level to be served by system pressure under normal daily operating conditions. The system will maintain 30 psi minimum pressure under design fire flow requirements (see Section 6.501).

All distribution water mains, appurtenances, and service lines will be designed for a minimum normal internal working pressure of 150 psi plus allowance for water hammer. Working pressures for transmission lines will be verified with the Water Resources Department.

Water hammer may produce momentary pressures greatly in excess of normal static pressures, thus increasing the probability of water main failure. Suitable provisions must be made to protect the system from water hammer pressures. The occurrence and severity of water hammer can be reduced by using slow-closing valves, pressure-release valves, surge tanks, variable frequency drives, soft start motor controllers, and air chambers. In cases where pressures exceed 120 psi or water hammer conditions are developed, all elements of the system will be designed accordingly.

PRESSURE REDUCING VALVES (PRVS) 6.407

Approximate pressure zone boundaries and their respective elevations are referenced in Figure 6-3. PRVs will be required when necessary to maintain pressure zones within the distribution system. Distribution systems will not be designed to operate at pressures in excess of 120 psi. PRVs shall be designed in accordance with COS Standard Detail No.

2342-1 and 2342-2 and the city's Design Standards Development for Pressure Reducing Valves and Air Relief Valves (www.scottsdaleaz.gov/design/DetailDrawings). A minimum of one PRV in each pressure zone will be designed with a high-pressure relief valve.

Vaults will be located outside of paved areas generally adjacent to the back of curb or sidewalk. PRVs will be located within the rights-of-way, an easement, or an easement within a private street tract, and will be provided with unobstructed vehicular access. Curbs adjacent to PRV vaults will be roll or mountable type. Site grading will route storm water and discharge water from relief valves away from the vault. Site design will consider the impacts of discharge water on downstream improvements. The location of pressure relief risers will be shown on the final plans.

The engineer will specify on the final plans, the size of the main line and bypass pressure reducing valve, the upstream system pressure, and the design downstream pressure setting. Where multiple PRVs supply a pressure zone, the engineer may request the Water Resources Department to consider eliminating the bypass valve on redundant installations.

Scottsdale operates its system from wells and pumps that commonly have pressures exceeding 80 psi. Changes in demand, supply, and the operation of the distribution system also vary the pressure within the system. Therefore, the city requires all metered services to have a pressure-reducing valve installed on the private service line. A written variance request may be submitted to the Water Resources Department for their review and concurrence, or denial. The Uniform Plumbing Code requires a pressure regulator when local water pressure exceeds 80 psi.

6.408 FITTINGS

No water line will be deflected either vertically or horizontally, in excess of that recommended by the manufacturer of the pipe or coupling, without the appropriate use of bends or offsets. Fittings may be required where more than two pipe lengths are deflected. The Water Operations Division will approve deflections exceeding 4 degrees.

A minimum distance between fittings will be specified on the final plans for constructability. The engineer is responsible for verifying the minimum distance necessary for the type and diameter of pipe and related fittings specified for the project.

6.409 SHUTOFF VALVE LOCATIONS

Shutoff valves will be installed on water mains at locations within the distribution system that allow sections of the system to be taken out of service for repairs or maintenance without significantly curtailing service in other areas. Special consideration should be given to the number of fire hydrants taken out of service. A sufficient number of valves should be provided on water mains so that inconvenience and sanitary hazards will be minimized during repairs. Valves will be located such that closing no more than 4 valves can isolate any section of the system.

Maximum spacing of water distribution main isolation valves shall be as follows:

- In commercial, multi-family, and industrial areas, valve spacing will not exceed 500-foot intervals.
- In single-family residential and other areas, valve spacing cannot exceed 800-foot intervals, or one per block, whichever is less.

Maximum spacing of water transmission main isolation valves will be as follows:

- At every mile section line, install a cross with a valve on each leg of the cross.
- Valves spacing between mile section lines will not exceed 1,320 feet.

1. Any design not complying with the above spacing requirements must be approved in writing by the Water Resources Department.

2. Install all tees with a valve on the lateral line so that the lateral can be taken out of service without interrupting the supply to other locations. At intersections of distribution mains, the required number of valves will normally be one less than the number of radiating mains. The unvalved branch is usually the line that principally supplies flow to the intersection. Install shutoff valves for new construction at the point of curvature (PC) of curb returns at street intersections, and aligned with a property line or lot line at mid-block locations.
3. Provide valves to allow for isolation of lines crossing washes with a capacity exceeding 500 cfs, major and minor arterial roads, bridges, and locations where lines have been vertically deflected to cross other infrastructure.
4. Provide a valve on each hydrant branch and flange it to the tee.
5. Do not install valves in sidewalks, curbs, multi-use paths, or bicycle lanes.
6. Ensure that all valves 12 inches or smaller are resilient wedge type. Valves 16 inches or larger shall be low torque resilient wedge or butterfly type. All valves 16 inches or larger shall have bypasses per COS Standard Detail No. 2361. The valve operators on butterfly valves 16 inches or larger in diameter shall installed entirely with a manhole for repair or replacement. Be sure to configure entrances to manholes so that the internal valve parts can be serviced.
7. Pressure rating on all valves will be equal to or greater than the pressure rating of adjacent pipe.
8. All valves require valve boxes installed per MAG Standard Detail No. 391-1, Type C, with locking lids. When located outside of the pavement area, valves will be installed with a debris cap. Make sure the debris cap's handle is the appropriate color to indicate valve type.
9. All valve frame and cover adjustments will be per COS Standard Detail No. 2270.

AIR RELEASE VALVES 6.410

Air release valves will be installed at all changes in slope of water lines 8 inches or larger in diameter, as follows:

1. When water line changes from a positive slope to a zero slope, or a negative slope, in the primary direction of flow;
2. When water line changes from a zero slope to a negative slope in a primary direction of flow;
3. For vertical alignment changes to cross under or over another facility (i.e., utility, drainage washes, etc.). Refer to COS Standard Detail No. 2370 and Section 6.415, Vertical Separation and Vertical Alignment.

Slopes less than or equal to 0.002 ft/ft shall be treated as zero slopes. In the absence of any changes in slope, air release valves will be installed not more than 2,640 feet apart.

All air release valves will be a combination air/vacuum release type, per COS Standard Detail No. 2348.

Air release valves will be installed in 6-inch water lines under the following circumstances:

1. The high point of the line if no lateral line, fire hydrant, or water service connection is proposed at that location to adequately remove trapped air.
2. For vertical alignment changes to cross under or over another facility (i.e., utility, drainage washes, etc.). Refer to COS Standard Detail No. 2370 and Section 6.415, Vertical Separation and Vertical Alignment.

Air release valves on lines 12 inches and smaller can generally be located in a manhole over the water line. Air release valves on lines 16 inches and larger may need to be located in an above-grade enclosure adjacent to the roadway where applicable. Locations for all valves and vent pipes must be shown on the final plans and will be within the rights-of-way, private street tract, or easement.

Standard Detail drawings are online at www.scottsdaleaz.gov/design/DetailDrawings.

6.411 THRUST RESTRAINT

Thrust on pipelines occurs wherever bends or lateral branches exist. Thrust blocks will not be allowed for new construction on the city's water system unless approved in writing by the Water Resources Department. Thrust restraint will be provided by:

1. Welded joints in steel pipelines.
2. Mechanical joints in concrete and ductile iron pipelines.
3. Locking gasket and ring systems acceptable to the Water Operations Division.

The determination of whether or not a given section of pipeline needs restrained joints, or other means of anchorage, shall be made by the engineer and reviewed by Plan Review Services. All thrust restraint must be designed for one and one-half times the static line pressure or 200 psi, whichever is greater.

MAG Standard Detail No. 303-1 and 303-2 include acceptable means of joint restraint. The engineer should pay attention to the water pressures and soil bearing pressures assumed by the Standard Details. Where joint restraint per MAG Standard Detail No. 303-1 and 303-2 is not proposed, the engineer will submit joint restrain calculations with the final plans for review and comment.

All restrained pipe lengths must be specified on the final plans or referenced to a standard detail.

6.412 ELECTRONIC MARKERS

Final plans will call out where electronic markers are to be located, indicating all horizontal changes in direction. Valve locations permit adequate identification of pipeline location (typically at crosses and tees) and thus do not require electronic markers. An electronic marker must be placed at the center of all fittings at a depth of 3 feet below finish grade per COS Standard Detail No. 2397.

Long, straight reaches of transmission mains will be marked every 1320 feet with an electronic marker.

6.413 PIPE COVER

Cover, or depth of bury, for water mains will be measured from the proposed finished grade as follows:

1. For lines 12 inches in diameter, allow a minimum cover of 48 inches over the top of pipe.
2. For lines larger than 12 inches in diameter, allow a minimum cover of 60 inches over the top of pipe.
3. For all lines within industrial zoned areas or under major roadways (collector, arterial, couplet, or parkway/expressway), allow a minimum of 60 inches over the top of the pipe.
4. In all other locations, for lines smaller than 12 inches in diameter, allow a minimum cover of 36 inches to the top of pipe unless otherwise approved by the Water Resources Department.

If a water line is installed within an area to be filled at a later time, adequate pipe protection must be provided. This may include temporary berms or constructing the water line to a

minimum cover below the existing grade. The engineer should notify the Water Resources Department of such occurrences and address them in the design report or master plan.

Concrete encasement of new water lines is prohibited unless approved by the Water Resources Department. Concrete encasement of an existing water or sewer line may be allowed by Plan Review Services, where vertical separations otherwise cannot be achieved.

Caution should be taken in design and construction to protect all water supplies from wastewater contamination.

When more than 3 feet of existing polyvinyl chloride (PVC) or asbestos cement pipe (ACP) water lines are exposed during construction and the bedding is disturbed, the water line must be replaced with ductile iron pipe (minimum Class 350) with mechanical joints or flanged joints across the limits of exposure (MAG Standard Detail No. 403-3).

WASH CROSSINGS 6.414

All wash crossings will be constructed using restrained joint Class 350 ductile iron pipe. Bury requirements to place water lines under washes or channels shall be based upon the one hundred year peak design discharge (Q_{100}) in the channel or wash. The additional depth of bury is in addition to the normal cover requirements described in Section 6-413.

100 year flow rate	Additional depth of bury
1 to 49 cfs	1 foot
50 to 99 cfs	2 feet
100 to 499 cfs	3 feet
more than 499 cfs	Scour depth based on scour analysis

Scour depth will be estimated using Arizona State Standard Attachment (SSA) 5-96, Guideline 2, Level I, as published by the Arizona Department of Water Resources. The engineer will estimate the depth of scour and design the top of pipe to conform to Section 6-413. The engineer shall submit the scour analysis with the final plans.

All pipelines that must be located within the scour zone, or with less than the minimum required depth of bury as indicated above, must be protected by installing a cut-off wall, per COS Standard Detail No. 2228, downstream of the pipeline to stabilize the scour depth. Plan Review Services will review protection requirements under these instances on a case-by-case basis. Cut-off walls will be structurally designed to the scour conditions calculated.

VERTICAL SEPARATIONS AND VERTICAL REALIGNMENTS 6.415

Vertical separation of water and sanitary sewer lines must be in compliance with Arizona Administrative Code, Title 18 – Environmental Quality. Where conditions prevent adequate horizontal and vertical separation, both the water and sanitary sewer line will be constructed of ductile iron pipe (minimum Class 350) with restrained joints.

Separation of water from electrical or gas lines will conform to COS Standard Detail No. 2372.

Water lines crossing over culverts and storm drains must maintain both a minimum of 12 inches vertical separation and the minimum depth of bury. If the design cannot provide these clearances, a vertical realignment is necessary.

For minimum clearance under culverts, storm drains, and other utilities, refer to COS Standard Detail No. 2370 and 2372. The vertical realignment shall be constructed of class 350 ductile iron pipe and shall not be deflected or swept. Air release valves and isolation valves will be installed as per the following:

1. Install isolation valves on each side of the vertical realignment to minimize disruption of service should the crossing need to be isolated for maintenance or repair. Plan Review

Services may consider the location of adjacent valves, fire hydrants, and water service lines to help minimize valves at vertical realignments.

2. For dead-end water lines, place the required air release and isolation valves on both sides of the vertical realignment.
3. For looped applications, install air release valves at a location calculated by the engineer to release any air trapped in the system.
4. Do not place tees, fire hydrants, service lines, and other appurtenances within any portion of the vertical realignment unless approved in writing by Water Resources.
5. Give special attention to vertical realignments on existing waterlines in order to avoid disruption to the distribution system. Prior to connection, vertical realignments over 25 feet in length will be constructed a minimum of 3 feet offset from the existing line and tested per MAG Uniform Standard Specifications for Public Works Construction and COS Supplement to MAG Uniform Standard Specifications for Public Works Construction. Use separate horizontal or vertical bends to change pipe alignment. Do not rotate fittings to accomplish combined vertical and horizontal deflections.

6.416 SERVICE LINES AND METERS

Do not place water service lines and meters in driveways, sidewalks, washes, or detention basins. The water service line and meter will be sized based upon the total demand for the development and should include residential fire sprinkler and irrigation demands.

That portion of the water service from the water main up to, and including, the meter is public and will be maintained by the city. That portion of the water service from the meter into the site is private and will be maintained by the property owner. Design of the private onsite portion of the water service will comply with the Uniform Plumbing Code.

Water service lines shall be one-inch minimum unless prior approval is obtained from the Water Resources Department.

Due to the city's water billing rate structure, meter sizes will not exceed the size of the service line (i.e. a 1-1/2 inch meter will not be allowed on 1 inch service). Extra attention is recommended when sizing services for custom home lots where demands occasionally necessitate meter sizes exceeding 1 inch.

Service lines are necessary to meet domestic, fire, and irrigation demands. Residential fire sprinkler and irrigation demand is usually supplied through the domestic service line and meter. Commercial developments typically will use separate meters for building and landscape service.

Each service line requires a separate tap to the public main. Connection of two or more meters in a manifold configuration is prohibited.

Installation of metered 1 inch to 2 inch water services will be in accordance with COS Standard Detail No. 2330. Installation of 1½ to 2 inch fire service lines use a saddle connection per COS Standard Detail No. 2362. Installation of 3 inch to 6 inch metered services require a tee and shut off valve, or tapping sleeve and valve, on the public main, per MAG Standard Detail No. 340 and 391-1, Type C, and a meter vault in accordance with COS Standard Detail No. 2345. Meters are not required on services used solely for fire sprinkler systems.

Final plans will show locations of service lines and meters to each unit referenced with stations and dimensions, or offsets, from the street centerline or monument line. Service lines and meter boxes will be located within a public rights-of-way easement within a private street tract, or a utility easement. Meters are to be accessible to city workers and be located as close as possible to the water main.

Water service lines on lots smaller than 1/2 acre will be located within 3 feet of the property line adjacent to adjoining parcel's water service line. Water service on lots 1/2 acre and

larger will be located within the lower 1/3 of the property frontage to the water main avoiding Natural Area Open Space (NAOS) and adjacent to the sewer service where practical.

Water services will be designed perpendicular to the main where possible. Lines shall be continuous from the main to the meter with no bends or welded joints. Water service lines will have 6 feet minimum horizontal separation from sanitary sewer service lines.

No service connections or fire protection systems will be made directly to water lines 14 inches or larger in diameter, or to water lines designed solely to transmit water from one pressure zone to another pressure zone.

All galvanized iron and polyethylene water service lines in sizes 3/4 inch through 2 inch which are exposed during construction will be replaced in their entirety with Type "K" copper tubing. This includes the replacement of iron service saddles with bronze saddles and replacement of both the corporation stop and meter stop in all cases.

Existing water services not used by a development will be noted on the plans to be abandoned at the main.

BACKFLOW PREVENTION & CROSS CONNECTION CONTROL 6.417

All metered services within the city, other than single family residential, require the installation of an approved backflow prevention device immediately adjacent to the meter on private property. To determine the type of backflow protection required for a specific use, refer to Chapter 49, Division 3 (Backflow Prevention and Cross Connection Control) of the Scottsdale Revised Code (www.scottsdaleaz.gov/codes). The back flow prevention valve and the service line will be of equal size unless the engineer submits calculations with final plans demonstrating the losses through a smaller device do not adversely effect water pressure to the building.

For installation requirements, please refer to the current version of the COS Standard Detail No. 2351 through 2356. The backflow prevention device is to be owned and maintained by the property owner.

Backflow prevention devices larger than 2 inches require location to be scaled and stationed on the final plans.

Fire lines require backflow prevention at either the property line or within the vertical riser (when permitted). See Section 6-504, for additional information.

The city requires backflow prevention on temporary construction meters for all extensions of the water system per COS Standard Detail No. 2346. For additional information, contact the Water Operations Division backflow prevention specialist.

SAMPLING STATIONS 6.418

Water sampling stations are generally required in all new residential subdivisions consisting of twenty or more platted lots. Developers are required to contact the Water Quality Division prior to the preliminary plat submittal. The sampling stations are to be located within the rights-of-way, private street tract, or utility easement at mid-street, 3 feet behind the sidewalk, along a property line extension.

Construction will be per COS Standard Detail No. 2349. One sampling station will be required for every 300 dwelling units or less. A large development constructed in phases will be required to install the sampling station on the first phase and each subsequent phase when the dwelling units for all phases constructed exceed 300 units. Manufacturer of these sampling stations shall be "Koraleen," or approved equal, with a stainless steel ball valve.

TRACT AND EASEMENT REQUIREMENTS 6.419

Water lines outside of a public rights-of-way or a private street tract must be placed in a minimum 20-foot wide easement located within a dedicated tract (portion of a utility tract,

drainage tract, or open space tract), unless approved otherwise by the Water Resources Department. Horizontally, a minimum of 6 feet is required between the water line and the edge of the easement. The tract/easement shall be accessible from public rights-of-way. The easement will be free of obstructions, not be located in a fenced area, and be accessible at all times to city service equipment such as trucks, backhoes, etc. Areas in question shall be approved in writing by the Water Resources Department. In situations where encroachment into the easement with structural improvements, such as screen walls and paving, cannot be avoided, the Plan Review Services will request an indemnity agreement from the property owner.

No water line will be installed in an easement, outside of a tract dedicated to the city, unless the Water Resources Department has approved in writing the placement of the line in an easement, and the property owner has granted the necessary easement to the city.

Water line easements, outside of paved areas, shall have a 10-foot wide hardened path with a cross-sectional slope not greater than 10% and a longitudinal slope greater than 20%. The hardened path shall consist of native soil compacted to 95% to a depth of 1 foot from the existing or design surface, whichever is lower. Any revegetation within the easement will consist of low growing shrubs or plant material acceptable to the Water Operations Division. Trees may be located along the edge of the easement but not within 7 feet of the water line as measured to the trunk of the tree.

If access across a wash is not practical, the Water Resources Department may approve turn around areas at each side of the wash. Hammerhead turnaround configurations are acceptable allowing for turning movements of a full size pick up truck.

A copy of any written approval from the Water Resources Department shall be submitted with the final plans.

6.420 EASEMENT ABANDONMENT REQUIREMENTS

When a property owner or developer believes a water line easement, or portion thereof, is no longer required by the city, an abandonment may be requested by completing and filing an application through the city's One Stop Shop.

After completing and filing the application, the property owner or developer will send a letter requesting abandonment of the easement, along with the reason, to the Water Resources Department with the following exhibits attached:

1. A detailed map highlighting the easement to be abandoned, and locations of existing water and sewer lines shown in reference to the easement.
2. If existing water and/or sewer lines are to be abandoned, a detailed civil plan prepared by a professional engineer licensed in the state of Arizona must be supplied describing the method of abandonment and any necessary relocations of the water and/or sewer lines.
3. The Water Resources Department will issue a letter recommending approval or denial of the abandonment request and any stipulations that may be required in conjunction with the abandonment.
4. This letter will be attached to an Application for Release of Easement and will be submitted by the applicant to the One Stop Shop for subsequent processing by Development Services.

Failure to comply with the above process will result in a denial of the request. Where replacement rights are requested by the city, the city will not relinquish existing rights until the replacement rights have been granted.

FIRE PROTECTION 6.500

It is the intent of the Fire Department to establish requirements consistent with nationally recognized practices for safeguarding, to a reasonable degree, life and property from hazards of fire and explosion arising from the storage, handling, and use of hazardous substances, materials, and devices and from conditions hazardous to life and property arising from the use or occupancy of buildings or premises.

A. Ordinance Requirements

City Ordinance #3507 amending certain sections of the 2003 International Fire Code (IFC). City Ordinance #2785 amending certain sections of the 1994 Uniform Plumbing Code (UPC). Refer to www.scottsdaleaz.gov/codes/FireOrd/.

B. Design Policy

If the property is to be supplied with domestic service and with fire flows from a storage tank or facility, the engineer must provide a report indicating that sufficient volumes exist, as required by the Fire Department, and are available to meet the calculated fire demands as defined by the engineer.

Particular attention will be given to fire hydrant locations on final plans for infrastructure where future building locations are not identified. Final building location and elevation may necessitate the addition of another water line, fire hydrant, and/or fire pump to serve that structure after the city has accepted the system. Compliance with the fire hydrant spacing and pressure requirements are the responsibility of the party requesting a building permit, as they are a condition of that property's development.

FIRE FLOW REQUIREMENTS 6.501

Water distribution facilities shall be sized to deliver a minimum fire flow of:

1. 1,500 gallons per minute (gpm) plus fire allowance for the fire sprinkler systems for commercial, industrial, and multifamily residential properties.
2. 1,000 gpm for single-family residential properties located in the county.
3. 500 gpm to one and two family residential properties with interior fire sprinkler systems.
4. Large structures, public assembly buildings, and high rise buildings may require fire flow above 1,500 gallons per minute. Verify fire flow requirements with the Fire Department.

The 1,500 and 500 gpm fire flow requirements are stated in Scottsdale Ordinance 3507 for fully sprinkled developments. The 1,000 gpm fire flow requirement is stated in the International Fire Code and does not assume a fully sprinkled development.

HYDRANT LOCATIONS 6.502

The spacing of fire hydrants is to be measured along the street or roadway in which a fire hose would be laid. Generally, this spacing is measured along the curb line and shall be inclusive of the distance up a private driveway to the proposed structure.

The Fire Department will stipulate fire hydrant locations during the site planning process or on the final plans review. The following standards shall be used as a guide:

1. The spacing of the fire hydrants in developments consisting of lots with single-family residences on each lot must be no more than 1,200 feet on center when street grade is less than 9%, and no greater than 600 feet on center when street grade is greater than 9%. When a cul-de-sac is greater than 600 feet in length, an additional fire hydrant must be installed. A residential structure must be located within 600 feet of a fire hydrant as measured along the streets and driveways. Additional hydrants and

attention to the spacing may be required to meet the distances above for large lots including, but not limited to, those areas zoned R1-18 (18,000 square feet) or greater.

2. The spacing of fire hydrants in commercial and industrial areas and in multi-family residential developments such as apartments and condominiums must be no greater than 700 feet. This spacing applies to interior, on-site locations for hydrants as well as to locations along public rights-of-way or private street tract. A structure in this category must be located within 350 feet of a fire hydrant as measured along the accessible fire routes.
3. The spacing of the fire hydrants in the county must be no more than 660 feet. No structures shall be located more than 330 feet from a fire hydrant, as measured along the rights-of-way, private street tract, or utility easement.
4. A six-inch fire hydrant lateral shall not be tapped for fire sprinkler supply lines.
5. Auxiliary fire hydrant valves must be connected to the main water line by flanged tee.

Contact the Fire Department Plan Review for any additional information.

6.503 PAVEMENT MARKERS

Two-way, reflective blue raised pavement markers must be provided to identify the location of the fire hydrants and remote fire department connections in accordance with COS Standard Detail No. 2363. These markers are readily available from businesses providing highway marker materials.

6.504 FIRE LINES AND BUILDING SPRINKLER LINES

1. Determine the location of on-site fire lines and taps by the site relationship of the fire department connection, riser location, emergency access, and fire hydrant locations. Determine the size of fire lines from the flow test data provided by the engineer for design of the project. Fire systems must include a city approved backflow prevention device. An approved, vertically mounted backflow prevention device, located on the building riser, is preferred by the Fire Department to a separate (redundant) exterior backflow prevention device.
2. Show all fire lines on the civil site final plans.
3. Do not connect fire lines to transmission mains that are 14 inches or larger.

6.505 BUILDING SPRINKLER SYSTEM REQUIREMENTS

The water system design must accommodate the requirement for building sprinkler systems. The following are structures that require building sprinkler systems:

- All new commercial or industrial buildings (including basements).
- All multi-family residential structures (apartments, condominiums, time-share developments, etc.).
- All parking area structures (underground or aboveground).
- All single-family residences constructed after January 1, 1986.

6.506 SPRINKLER SYSTEM DESIGN

Base building sprinkler system design on a certified flow test, or submit as shop drawings after a building permit has been issued. The drawings will be of uniform size (24-inch by 36-inch) and drawn to scale. One set of the approved civil water final plans need to accompany these submittals. Also include on the working drawings any applicable city of Scottsdale and International Fire Code construction notes. Have the building sprinkler contractor submit 3 blue line sets of the final plans, calculations, and supporting documents to the One Stop Shop for review by the Fire Department.

Include a note on the final plans that the "Installation will be per approved final plans. Any deviation from approved final plans will require written permission of the authority having jurisdiction."

Inspections will be per National Fire Protection Association Standards (NFPA) 24 and as required by the Fire Department.

REMOTE FIRE DEPARTMENT CONNECTION 6.507

If a remote Fire Department connection for a sprinkler system is required, it must be installed between four and eight feet from the back of curb of a public or private roadway. The location of the sprinkler system connection must be unobstructed and readily accessible to the Fire Department. Reference the standard details in COS Interpretations and Applications of NFPA 13, 13R, 13D (2002) Edition, and COS Standard Detail No. 2367. This connection must also be within an appropriate distance of a fire hydrant as determined by the Fire Department. Refer to www.scottsdaleaz.gov/codes/FireOrd.

Pavement markers for Fire Department sprinkler system connections must be provided as shown in COS Standard Detail No. 2363.

AUXILIARY STORAGE TANKS 6.508

Water pressures and discharge flow required by the Fire Department will be for a minimum of 2 hours for commercial projects. A fire pump package installation may be required when the building's construction type, occupancy fire load commodities' classification, volumetric building areas, building height, and individual square footage areas per floor level produce a pressurized fire flow demand in excess of the water transmission mains capabilities.

For residential sprinkler requirements see the Scottsdale Interpretations and Applications of NFPA 13, 13R, 13D (2002) Edition. Refer to www.scottsdaleaz.gov/codes/FireOrd/.

FINAL PLANS PREPARATION 6.600

General requirements for the preparation of final plans in the city of Scottsdale are described in Construction Plan Submittal Requirements in Section 1.2. This section supplements those general requirements of Chapter 1.

A. Ordinance Requirements

Upon development of the property for which city water service is desired and available, the developer will submit a plan for the water system prepared by a professional engineer licensed in the State of Arizona.

B. Design Policy

Any variance to these standards will require written approval from Water Resources.

GENERAL REQUIREMENTS 6.601

All extensions of the distribution system require pressure and flow testing. Include the results of the testing on the final plans cover sheet.

When a water line is to be connected to an existing system, the following note shall be placed on the final plans: "Contractor shall verify the location of the existing water line and type of material before proceeding with trenching."

SPECIFIC WATER PLAN REQUIREMENTS 6.602

For transmission and distribution lines, submitted the following for city approval:

1. For permitting purposes, include on the cover sheet of the final plans quantities for all items of work within the public rights-of-way, private street tract, and public easements. The engineer will submit an estimate of probable cost for pressure reducing valve assemblies to establish those permit inspection fees.
2. Station water lines along the centerline of the street or the pipe. Profile all water lines 12 inches and larger with line gradients and elevations. Show in profile the finish ground elevations over the water line where the water line is constructed outside of paving, or show in profile the finish pavement design elevations where the water line is constructed under paving.
3. Where water lines cross sewer lines, storm drains, or drainage culverts, show the relationship in both plan and profile with minimum clearances dimensioned. Identify all pipes, valves, appurtenances, etc.
4. Identify water line service locations with a meter station and offset.
5. On the drawings, show all utility locations, sizes, easements, rights-of-way, and other structural features of the water line. Note pressure reducing valve settings and sizes on the plan.
6. Note and show in plan view easements within tracts, including docket and page numbers or recorder's number.

All construction documents will be prepared by a registered professional civil engineer licensed in the State of Arizona under the provisions of ARS 32:141-145.

Booster Pump Stations and Reservoirs require separate plans submittals. The city has specific design requirements for the design and preparation of final plans for these facilities. Contact the Water Resources Department for the latest requirements.

6.603 REVIEWS AND APPROVALS

All final plans that include connection to or extension of the city's water system, or on a system that is to be dedicated to the city, must be submitted to the One Stop Shop for review and approval. Plan review fees must be paid at the time of plan submittal.

No final plans will be submitted to the city unless accompanied by a copy of the fire flow test results, or, when stipulated, the accepted basis of design report. Master plans or design reports must be submitted separately through the One Stop Shop for review by the Water Resources Department.

Maricopa County Environmental Services Department approval is required, prior to approval of final plans by Plan Review Services, when extension of the public water system is proposed. No permits for public water line construction will be issued until the owner or developer has provided the necessary easements and rights-of-way. The instruments of dedication must be approved and submitted to the city for recording at the Maricopa County Recorder's Office.